US Experiences in Integration of Demand-Side Resources and Market Mechanisms

美国经验介绍:需求侧资源的整合利用与市场化机制的推动



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Outline

大纲

- Polices at a glance
- New challenges
- New developments

- 政策回顾
- 新的挑战
- 新发展

Policies are essential for DR development

扶持政策是需求响应发展的关键

2007

FERC Order 888 & Order 889 联邦能源监管委员会第 888及889号令

1996

1992

Order 888: unbundling wholesale generation and power markets from transmission services Order 889: establishing a webbased system allowing energy customers to participate in the wholesale market

解除了发电及电力批发市场与输 电服务的绑定,要求输电商向公 开市场提供输电服务

Energy Policy Act of 2005 2005年《能源政策法》

2005

Eliminating barriers at the national level for DR resources to enter energy, capacity and ancillary service markets 消除进入电量、容量和辅助 服务市场的阻碍, 明确支持需 求响应

FERC Order 719联邦能源监 管委员会第719号令

2009

Permitting the bidding of DR directly in the wholesale market 允许需求响应直接参与批发市 场竞价

> FERC Order 755联邦能源监管 委员会第755号令

2011

2015

Allowing DR to be compensated at the market price for energy 确认需求响应 可以成为平衡能源供需的措施, 并要 求对需求响应进行相应的补偿

> FERC Order 745 联邦能 源监管委员会第745号

Energy Policy Act of 1992/1992年能源政策法

Allowing utility investments in energy efficiency and demand-side management to be "at least as profitable" as traditional supply-side investments

规定在能源效率和需求侧管理上的电力投资与传统供

Energy Independence and Security Act of 2007 2007年《能源独立与安全法》

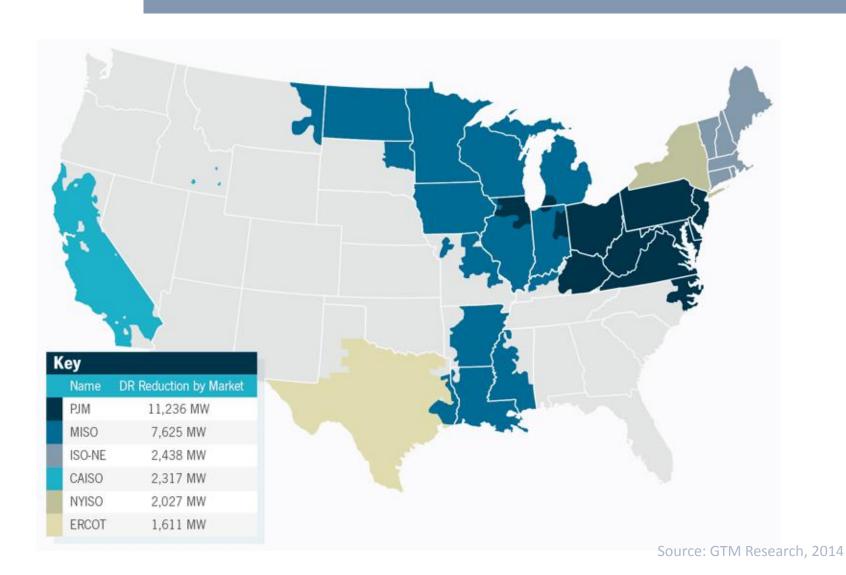
Directing FERC to assess the total and achievable potential, identify barriers, and develop policy recommendations

指示联邦能源委员会对全国需求响应潜力做出评估

Allowing DR resources to receive the local wholesale market price in both real-time and day-ahead markets允许 需求响应在实时市场和日前 市场内享受当地的批发市场 价格

Different types of markets and mechanisms exist

美国各个地区建立不同类型、不同规模的市场机制

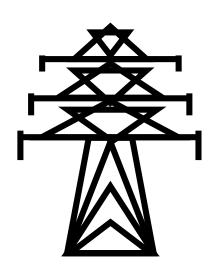


Power grid has been facing new challenges

电网系统面临新挑战

Historically 以前

- Safe operation 电网系统安全运行
- Reliable power supply 确保供电





Now | 现在

- Smarter grid 智能化
- More flexibility提高灵活性

Several factors exist behind these new challenges

不同因素导致了这些新挑战

Growing energy efficiency Slowing-down growing rate of electricity sales 能效的提升、售电量增长速度缓慢

Increasing application of demand-side resources 需求侧资源的广泛利用

More pressure on cleaner, more efficient electricity service 政策目标要求更清洁、更具有成本效益的电力资源

Increasing non-utility market actors 电力公司以外,更多服务商进入电力市场

Aging grid infrastructure 电网基础设施老化

能效

需求侧 资源

清洁能源 消纳

> 负荷 <u>集成</u>商

> > 成本 效益

Demand response (DR) helps address the challenges

需求响应有助于应对新挑战

Integrate more renewable energy into the grid 消纳更多可再生能源

Reduce the need for additional coal-fired power plants 减少新建煤电厂的需求

New business models and opportunities for different market actors 提供创新商业模式及机遇

to reduce peak load 应对电网紧急 削减高峰负荷

Boost demand for energy efficient product and smart technologies 推动高效、智能产品发展

Reduce GHG and conventional air pollutants 减少温室气体排放及传统污染物

Changing conditions promote aggregated demand side resources

变化的条件有助于促进需求侧资源的聚合

Aggregating demand side resources (e.g. appliances, battery storage, EV, PV, etc.) can provide diverse products that:

汇总需求侧资源(如电器、电池、电动车、光伏电池等)能 提供多样化的产品:

- Quickly respond to shifting supply and demand 快速响应不断变化的供需要求
- Provide year-round value and service (seasonal, daily, hourly, etc.) 提供全年的价值和服务(季节性,每日,每小时等)

PJM – Capacity Performance for Emergency DR

PJM - 应急DR容量性能要求

Generators

- must meet their commitments to deliver electricity whenever PJM determines they are needed;
- may receive higher capacity payments as a "pay-for-performance" requirement;
- that exceed performance commitments will be entitled to funds
- collected from generators that underperform;

 assume virtually all financial risks if they do not meet their power supply obligations. (for 2018/19 delivery year)

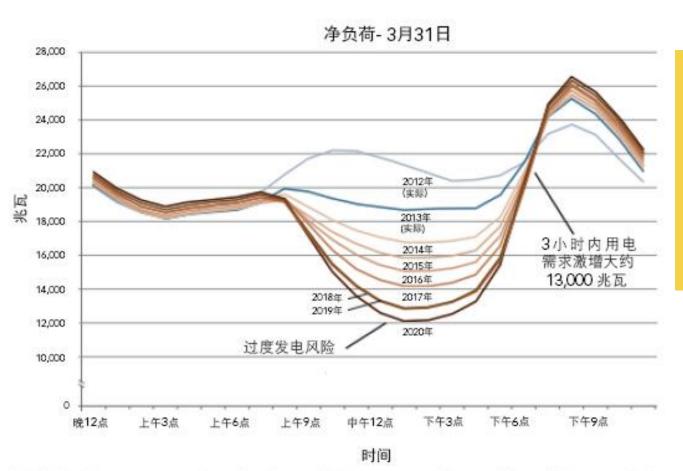
发电方

- 依PJM决定必须满足其提供电力的承诺
- 按绩效可能会收到更高的容量付款
- 如超过业绩承诺将有权获取从未达承诺方收集的资金
- 承担几乎所有不满足供电义务金融风险

(供应年2018/19)

Dispatchable DR helps California to meet energy needs

可调度需求响应已用于满足加州的能源需求



- □ Avoid use of fossil fuel 避免使用化石燃料
- □ Preferred option for renewable electricity generation 可再生能源发电的 首选方案

每日电力供需预测显示,由于太阳能和风能的加入,加州电网正在出现新变化,即午间用电净负荷下降,傍晚出现急 剧攀升的负荷尖峰。这种现象因其形状被称为"鸭形曲线"。

预计3月31日(2012-2020年)净负荷增长趋势迅猛,存在过量发电风险。

California integrates distributed energy resources to market

加州把分布式能源资源纳入到电力市场

Aggregated Individual Energy Resources | 集成的个体能源资源

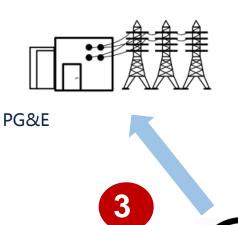


rooftop solar | 分布式光伏
plug-in electric vehicles
插电式电动汽车
energy storage | 储能
demand response resources
需求响应资源

Considered as a market resource | 作为市场资源可参加电力市场

Utility pilot with managed charging, and battery storage providing grid services

电力公司试点利用有序充电及电池储能提供电网服务



PG&E contacts BMW server (OpenADR 2.0b) to request load drop

PG&E 联系(利用OpenADR 2.0b)宝马的服务 器请求负荷降低



宝马服务器 **BMW Server**

Monitoring equipment verifies that total desired load drop is achieved.

监控设备证实成功实现降低总 需求负荷

100 kW



用户的汽车

Customer Cars

BMW selects vehicles for charging delay based upon owner preferences and notifies customers, who can opt out as desired. Stationary battery provides additional power as needed.

宝马通过用户的倾向选择延 迟充电的车辆并通知用户 用户可以选择退出。固定电 池提供所需的额外电量。

Supporting policies should remove market barriers

扶持政策应消除机制和市场壁垒

US experience shows demand side resources can contribute equally with or without the development of an organized wholesale market, but enabling policies and regulations must be in place.

美国经验表明,需求侧资源作用的发挥不一定以电力批发市场的存在为前提,但是扶持政策和法规要到位。



Natural Resources Defense Council 自然资源保护协会

- Established in 1970
- International environmental nonprofit organization
- Expertise of some 500 scientists, lawyers and policy advocates
- Two decades working in China since 1996
- NRDC Beijing Office with 40 specializing in policy research, introducing global best practices, and providing technical and legal assistance
- □ Collaborating with government agencies, research institutes and non-profit organizations to promote green, circular and low-carbon development in China

- □ 成立于1970年
- □ 国际环保公益组织
- □ 以科学、法律、政策方面专家为主力
- □ 在中国开展工作已有20年
- NRDC北京办公室现有成员约40名。主要工作内容为政策研究,介绍国际先进实践,以及提供技术和法律方面的专业支持。
- □ 与政府机关、研究机构和国内外公益组织一直积极开展合作与交流,促进中国的绿色、循环、低碳发展。

THANK YOU

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NATURAL RESOURCES DEFENSE COUNCIL

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